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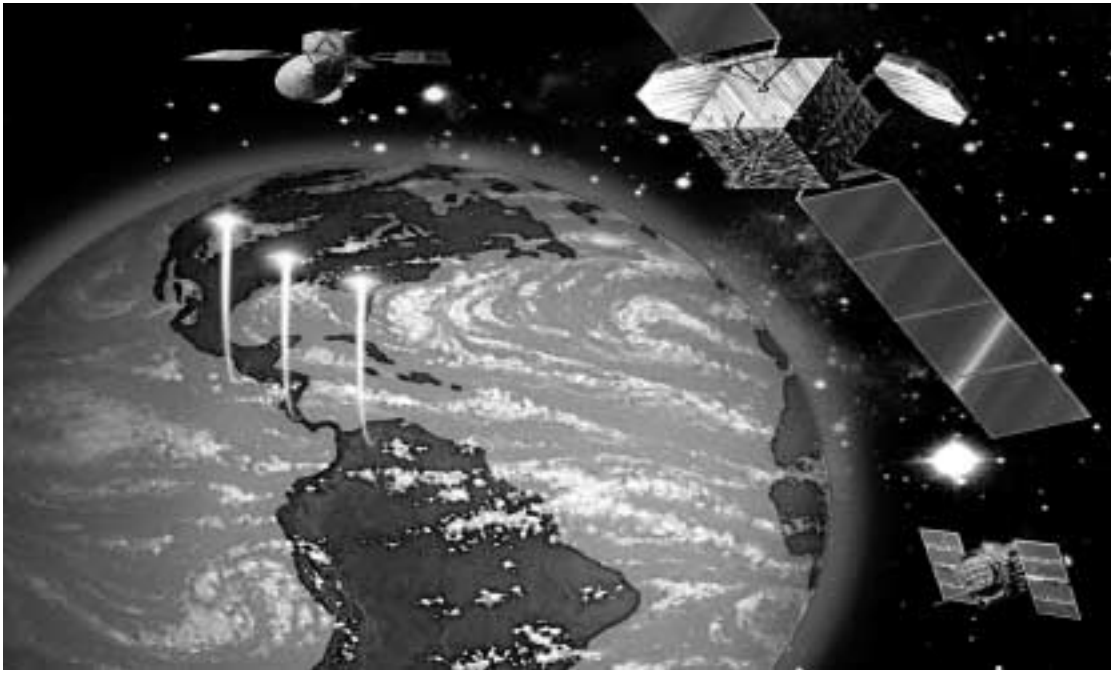
Latin American Countries with Space Programs
Colleagues or Competitors?

LT COL ROBERT D. NEWBERRY, USAF

Editorial Abstract: Colonel Newberry's three-tiered analysis of Latin American space programs identifies (1) owner/operator states with mature space programs, (2) material participants with well-developed research and intellectual capabilities, and (3) countries that willingly participate in space programs with other nations by means of intellectual or capital contributions.



SPACE TECHNOLOGY, NOW taken for granted, is an accepted part of modern life. Space-derived products and services for communications, imagery, navigation, and weather forecasting are available to everyone around the world, even in less-developed and underdeveloped regions. Every country in Latin America has access to a wide variety of space-based services. Telecommunications are available through International Telecommunications Satellites (INTELSAT), International Maritime Satellites (INMARSAT), and Iridium telephones, in addition to many satellite television and radio broadcasts

throughout the hemisphere. News reporters routinely use satellite-communications videophones for live reporting in remote areas of Latin America. Space-derived imagery products are available from indigenous regional satellites, several commercial-imagery satellites, and the Internet. The Global Positioning System provides free navigation services, and that system's receivers are prevalent throughout Latin America. Regionally specific weather information is available from space-based systems. These space services have become pervasive due to their relatively low cost and the ability to access most of them by means of handheld units, small-dish antennae, or the Internet. As a region, Latin America has shown significant interest in developing indigenous space capabilities to assist with managing resources and exercising sovereignty. Brazil, Mexico, Argentina, Chile, Uruguay, Paraguay, and Peru in particular have participated in space programs beyond the level of merely subscribing to a satellite service.

The United States should routinely review Latin American space programs to ascertain their impact on its national-security interests. The primary such interest at stake with foreign space developments is the dual-use nature of space-launch technology. Space-launch missiles are inherently capable of being used for attacks against the United States. To date, the US ballistic missile defense program has focused on launches coming over the North Pole; those originating from south of the border could significantly complicate missile defense operations or render current plans ineffective. A secondary US national-security concern involves understanding the technical sophistication of foreign space systems to ensure that countermeasures can be developed to mitigate any military advantage they offer. Based on these two interests, the United States has pursued a policy of thwarting Latin American countries' missile developments while generally ignoring their space programs, considering them technically unsophisticated. Such a policy may not serve US long-term interests and should be reconsidered, based upon a better understanding of Latin American space needs and purposes. With an eye toward formulating a new space policy for the region, this article reviews the most significant space programs in Latin American countries and categorizes those nations as either colleagues or competitors of the United States.

This article also rates the space capabilities of Latin American countries on a decreasing scale from three to one. Level three includes those countries with a mature space program and an indigenous capability to own or operate space systems. They do not have the capability to independently produce large-scale spacecraft and launch them, but they do have the infrastructure and technical capability to develop spacecraft hardware. Level two describes those countries that have the research capabilities and intellectual capital needed to engage in a space program as material participants. They can contribute design ideas and some hardware to a space program, and they have the resources to process and analyze space-derived products. Level one refers to countries that are willing participants in other space programs and that can contribute either intellectual or financial resources to a collaborative venture with another space-faring country. These nations are collaborators to others' space programs.

Level Three: Owners/Operators

Brazil and Mexico are the largest owners and operators of space systems in the region and are the most space-capable countries. However, the similarity ends there, as the two have developed highly individualized, unique space programs. Brazil, the dominant space power in the region, is the major player in terms of funding and technical scope. Its Instituto Nacional De Pesquisas Espaciais has undertaken an aggressive and long-term space program dating back to 1979 with the inauguration of the Missao Espacial Completa Brasileira (MECB).[1] The three objectives of the MECB are to (1) design and build its own satellites, (2) possess an indigenous manufactured rocket, and (3) develop a launch center

on its own territory.[2] The MECB identifies remote sensing as the major Brazilian interest in space. The Brazilian government intends to use space capabilities to perform the following functions:

1. Investigate and monitor natural resources.
2. Map the Amazon and track the rate of deforestation.
3. Monitor agricultural production.
4. Provide communications to remote Amazon and Andean regions.[3]

Brazil developed a three-phase program to purchase needed space technologies while developing an indigenous capability to eventually replace the need for outside support. The first phase, which ran from 1973 to 1984, included the purchase of US Earth-resources data from the land satellite (LANDSAT) program and a program to develop information technologies to receive, record, process, analyze, and disseminate the information. The second phase, from 1985 to 1994, expanded the sources of imagery products, including the French Satellite Pour l'Observation de la Terre satellites and the European Earth Resources Satellites. This phase invested additional money in indigenous capabilities to build laboratories for space-imagery research, simulation, mapping products, and the development of geoprocessing techniques. The third phase, which started in 1995, will expand the technology base to other imagery products, such as microwave sensors, and the operation of their indigenously produced imagery and communications satellites.[4] Unable to produce a large-scale imagery satellite on its own, Brazil eventually entered into a joint-development project with the Chinese Academy of Space Technology for the China-Brazil Earth Resources Satellite (CBERS).[5] Brazil also codeveloped the companion Scientific Cientifico (SACI) satellites in collaboration with both the United States and China as a technology test-bed activity.[6] The tremendously successful MECB has provided Brazil with a robust and very capable space program.

Implementation of the MECB initially put Brazil at odds with the United States due to its objective of developing a rocket. The United States invoked the Missile Technology Control Regime (MTCR) in 1995 with the discovery that Russia was selling advanced missile technology to Brazil. Russia agreed to stop sales to Brazil, which cast the United States in a role of trying to stall that country's space program.[7] The fact that Brazil also explored the purchase of Cyclone missiles from the Ukraine and missile technology from China further irritated the United States. Brazil eventually decided not to oppose the United States and signed on to the MTCR in 1995. But agreeing to the MTCR did not open the doors to missile technology, and the United States insisted that Brazil agree to a Technology Safeguard Agreement (TSA) to allay concerns about technology transfers to third parties, particularly China.[8] Although the executive branches of both countries were able to reach agreement on the TSA, the Brazilian Congress has not ratified it because of significant concerns about the effect on Brazil's sovereignty. Brazil halted plans for developing an indigenous launch capability at Alcantara to appease US concerns and is now developing a commercial space-launch facility to compete with French Guiana for business.[9] The US Air Force planned to use Alcantara to launch a satellite on a Pegasus rocket but moved to Kwajalein Atoll since the TSA had not been ratified at the time of the January 2003 launch.[10]

The second area of US concern about Brazil's space program is its codevelopment of space technology with China. The initial CBERS development did not particularly trouble the United States since it considered the satellites relatively unsophisticated. At the time, China relied on the Fanhui Shi Weixing imagery satellites, which used film capsules with one-meter-quality images and had to be de-orbited from space.[11] For CBERS, China funded 70 percent of the project and launched the satellite from its own territory using the Long March rocket; Brazil contributed the rest of the funding, mostly tied to development of the 20-meter imaging pay-

load.[12] The main concern of the United States was that China was gaining a near-real-time reconnaissance capability instead of taking an average of three days to recover and process film capsules. Since the United States, France, European Union, and others already offered commercial imagery of better quality, the United States did not consider CBERS a significant threat to its interests. This attitude changed somewhat in November 2002, when China and Brazil announced their follow-on agreement to produce CBERS-3 and -4 to fund the program on 50-50 shares and improve the imaging payload to five meters.[13] The new agreement will also explore the feasibility of jointly developing a geostationary weather satellite based on the CBERS model.[14]

Partly as a consequence of the difficulty of working with the United States, Brazil has independently pursued its space program; however, its relationship with the United States has not been completely characterized by conflict, and Brazil has continued to participate in US-led space programs. For example, Brazil was the third country to participate in the US LANDSAT program and is the third largest user of US-provided satellite imagery.[15] It is supplying $120 million worth of hardware over five years to the International Space Station,[16] has an astronaut in the National Aeronautics and Space Administration's (NASA) space-shuttle cadre, and continues to participate in the hitchhiker program to place experimental payloads on the space shuttle. In addition to collaborating with the United States on microsatellite technology, Brazil has also teamed with other US allies such as the United Kingdom.[17] Although one might justifiably categorize Brazil as both a US colleague and competitor, it is principally a competitor.

Mexico, on the other hand, has a much less ambitious space program than Brazil's and a very different focus. Its major space interests involve integrating the country with telecommunications services for governmental command and control of resources and pursuing commercial activities such as banking and entertainment. Therefore, instead of emphasizing imagery, Mexico has concentrated on communications services. Like most countries, it was an early participant in the INTELSAT and INMARSAT programs and subscribed to US systems for telecommunications services for domestic audiences. In 1997 the Mexican government created the Satelites Mexicanos, S.A. de C.V. (Satmex) to oversee its satellite operations. Satmex teamed with Loral to operate the Morelos, Solidaridad, and Satmex telecommunications satellites Mexico purchased from the United States.[18] In 1996 the National Autonomous University (UNAM) launched the UNAMSAT-B microsatellite it had developed with the Radio Amateur Satellite (AMSAT) organization.[19] In general, Mexico's main space involvement has entailed financing space communications programs and contracting with US companies for their operation. Because Mexico has taken a decidedly cooperative stance with the United States in the development of space capabilities, it is one of America's space colleagues.

Level Two: Material Participants

Argentina and Chile are both capable of developing small satellites but have to team with other countries to undertake larger-scale space programs. Both nations are more fiscally constrained in their space spending than the level-three countries and do not have compelling national-security or economic interests that would drive a dedicated or more robust space program. Since their participation in space programs is not downward-directed, based on government priorities, they have been free to participate in a wide variety of programs without having to commit to the long-term operation of any particular system. Both Argentina and Chile, therefore, have pursued a strategy of breadth over depth, emphasizing the development of their intellectual capital over specific hardware.

Argentina's Comision Nacional de Actividades Espaciales (CONAE) had ambitious space-development plans prior to the devaluation of the Argentine peso in January 2002. In the 1980s and early 1990s, Argentina was developing an indigenous rocket program

called the Condor, which had space-technology applications. The Condor raised significant concerns in the United States due to its violation of the MTCR and the potential for technology transfer to Iraq.[20] As did Brazil, Argentina eventually concluded that its interests would be better served by cooperating with the United States on the MTCR. Thus, in 1995 Argentina joined the pact, cancelled the Condor program, and began pursuing a space program with the goal of integrating with the Brazilian program.[21] Over time, Argentina developed contacts with other countries and joined an AMSAT program, entering into a codevelopment program with Chile, Spain, and Brazil for the Cesar satellite, which has agricultural, water-management, and environmental-monitoring applications.[22] Argentina has also signed an intergovernmental agreement with China for bilateral space cooperation.[23]

This competitive stance changed somewhat in 1998 after President Bill Clinton named Argentina the only "major non-NATO ally" in Latin America.[24] CONAE had already participated with NASA in the development of the Satellite de Aplicaciones Cientifico (SAC) microsatellites as a space-research project.[25] As Argentina continues to seek closer military ties with the United States, mainly through peacekeeping operations, its space program now appears more cooperative with that of the United States. Its plans to develop the Satellites for Observation and Communications (SAOCOM)-1A radar satellite include Italy—another NATO ally of the United States.[26] Also, the United States views the launch of Latinsat-A and -B by Aprize Satellite in 2002 as a commercial endeavor with no national-security implications.[27] One reason the Argentine space program is now perceived as more pro–United States is that most funding for programs with US competitors has largely stopped as a result of the government's fiscal crisis and lingering economic problems. Considering its continuing links to competing, non-US space programs, one can consider Argentina both a US colleague and competitor.

Chile has taken an approach similar to Argentina's but on a smaller and more sustainable scale. First, Chile has proceeded at a slower pace and did not pursue domestic missile programs, a course that would have challenged the MTCR. Second, the Chileans have been flexible in their teaming arrangements without committing themselves to funding large space developments over long periods of time. Third, Chile has become more aligned with the United States in high-technology programs by purchasing F-16 aircraft. So, although Chile has explored coparticipating with Brazil and China on space programs, it has done nothing to cause the United States significant concern.

Unsurprisingly, then, bilateral military cooperation with Chile may expand into the area of space. Its main interest in space programs concerns scientific collaboration on Earth resources. Chile has recently formed a space agency and has opened dialogue with NASA. In addition to the Cesar satellites, mentioned above, the Fuerza Aerea de Chile (FACH) entered into a collaborative program with the University of Surrey in the United Kingdom to build the FASAT-1 scientific Earth-resources microsatellite, launched in 1998.[28] In 2002 Chile opened discussions with the United States for a follow-on collaborative program in this scientific area. Initial discussions have occurred between the FACH and US Air Force although future collaborative arrangements would include NASA and the new Chilean space agency.[29]

Chile's lightweight satellite (Lightsat) initiative has been discussed as a bilateral development by the United States and Chile. In June 2002, United States Strategic Command offered to sponsor a joint microsatellite experiment with Chile. United States Southern Command endorsed a proposal, and members of Strategic Command and the FACH exchanged visits in the summer of 2002. This proposal has completed staff-to-staff coordination and is awaiting endorsement by the US Air Force's Senior Steering Group for International Space Cooperation.[30] The program is consistent with Chile's past involvement in

space initiatives insofar as it will continue to gain technical expertise with space operations but not commit itself to funding large budgets or operating space systems over a long period of time. Chile's space program appears to be changing from a competitive to more cooperative relationship with the United States.

Level One: Collaborators

Uruguay, Paraguay, and Peru participate in the space programs of other countries without developing stand-alone space capabilities of their own. (One could argue that nearly every other Latin American country also fits into this category.) These countries have not allocated many resources to a space program and have no compelling national interests that would cause them to embark on one. They are participants of convenience with others' space programs and merit only passing mention as interested parties. French Guiana is omitted from this list since it is a "department" of the French government and not a sovereign country.

Uruguay, Paraguay, and Peru have discussed options for participating in space programs with their Mercado Comun del Sur (MERCOSUR) and Andean Pact neighbors. Brazil has generally served as the lead country in proposing multilateral space programs with these countries, but, to date, their participation has involved little more than technical-interchange meetings.[31] Their major interest in such programs is more academic and scientific than political, economic, or military. Also, hard fiscal realities and other pressing national priorities will likely mute their involvement as significant players in space programs for many years to come.

Latin American countries with space programs have a largely collegial relationship with the United States (table 1) even though the latter has generally thwarted their missile developments and ignored their satellite technology. Continuation of the current policy does not serve long-term US national-security interests since it could become a self-fulfilling prophecy by causing Latin American countries once again to pursue space programs that work more directly against those interests. One readily identifiable consequence of past US policy is the depth and breadth of contact that has developed between countries in the region and China. Positioning China as the dominant Latin American space partner does

Table 1

Summary of Findings

Level	*Country*	*Priorities*	*Status*
Three: Owners and Operators	Brazil	Imagery and Communications	Mostly Competitor
	Mexico	Communications	Mostly Colleague
Two: Material	Argentina	Microsatellite Technology	Moving from Competitor to Colleague
	Chile	Microsatellite Technology	Moving from Competitor to Colleague
One: Collaborators	Uruguay, Paraguay, Peru	Academic	Not Assessed

not serve US national-security interests. The United States should act now to forge more bilateral and multilateral ties with its Latin American neighbors, encourage Latin American space development, and integrate regional space aspirations with its own. Even without a specific policy review by the National Security Council, it appears that the needed change may be taking place as a natural evolution of US policy. If the Chile Lightsat initiative is successful, then it should become the model for cooperation and integration between US and Latin American space programs. □

Notes

1. English translation: Brazilian Complete Space Mission (BCSM).

2. Frank Braun, "South American Space: The Brazilian Space Program in Review," *Ad Astra*, November–December 2002, 16.

3. Ibid.; Marcio Nogueira Barbosa and Decio Castilho Ceballos, "The Brazilian Observation Satellites," *Acta Astronautica* 37 (1995): 505–7; and Decio Castilho Ceballos, "The Brazilian Space Program: A Selective Strategy for Space Development and Business," *Space Policy*, August 1995, 203.

4. Brazil has an impressive record of producing its own small-scale satellites, such as the Date Collection Satellites (SCD)-1, -2, and -3, as well as the Brasilsats (B1, B2, B3, and B4). Brazil also plans to field remote-sensing satellites (SRR-1 and -2) and ECO-8 communication satellites in low earth orbit.

5. Barbosa and Ceballos, 505–7.

6. J. A. Neri et al., "The Brazilian Scientific Microsatellite SACI-1," *Acta Astronautica* 39, nos. 9–12 (1996): 707–9. The United States provided a $4.6 million grant for SACI-1, launched in 1999 by the Chinese along with the CBERS-1 satellite.

7. R. Jeffery Smith, "U.S. Waives Objection to Russian Missile Technology Sale to Brazil," *Washington Post*, 8 June 1995, A23, A27.

8. Braun, 17.

9. Ambassador Sergio de Queiroz Duarte, statement to the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE Three), 20 June 1999, on-line, Internet, 12 June 2003, available from http://www.un.org/events/unispace3/speeches/20bra.htm.

10. Frank Dirceu Braun, "Romancing the Skies," *Brazzil*, October 2002, on-line, Internet, 23 June 2003, available from http://www.brazzil.com/cvroct02.htm.

11. A description of Fanhui Shi Weixing satellites is available on-line at http://www.fas.org/spp/guide/china/military/imint/index.html.

12. Wei Long, "China, Brazil Continue Remote Sensing Cooperation," *Space Daily*, 28 September 2000.

13. The 50-50 cost share and improved imaging performance had been announced previously. Xinhua News Agency publicly released the formal start of the follow-on CBER-3/4 on 28 November 2002.

14. Long.

15. Michael A. Taverna, "Pacts with China, Italy Spotlight Latin American Space Ambitions," *Aviation Week and Space Technology*, 9 October 2000, 125.

16. Braun, "South American Space," 16.

17. This refers to the development of the Abracos rainfall-monitoring satellite being developed with the United Kingdom. For a description of it, see the Instituto Nacional De Pesquisas Espaciais's Web site at http://www.inpe.br.

18. See the Satmex Web site at http://www.satmex.com.mx for a description of the Mexican satellites. For a description of Mexico's domestic space market, visit http://www.tradeport.org/ts/countries/mexico/isa/isar0055.html.

19. For a description of UNAMSAT-B, see UNAM's Web site at http://serpiente.dgsca.unam.mx/unamsat/unameng.htm.

20. "Missile Proliferation Developments in Brazil and Argentina," MIIS Seminar Series on Nonproliferation, 12 December 1991.

21. "Space Offers Fast Track to Technology Mainstream," *Aviation Week and Space Technology*, 4 March 1996, 49.

22. Taverna, 126. For more information, see the Cesar Web site at http://quidel.inele.ufro.cl/cesar1.

23. Virtual Information Center, 22 May 2002, on-line, Internet, 12 June 2003, available from http://www.vic-info.org.

24. See Presidential Determination no. 98-9, 6 January 1998, on-line, Internet, 12 June 2003, available from http://www.access.gpo.gov/su_docs/fedreg/a980126c.html.

25. SAC-B (1996), SAC-A (1998), and SAC-C (2000) were all launched successfully. For a description of SAC-A, see the NASA Web site at http://sspp.gsfc.nasa.gov/hh/saca/mission.html.

26. For a description of SAOCOM-1A and other CONAE programs, see CONAE's Web site at http://www.conae.gov.ar.

27. For a description of Latinsat, visit http://www.latintradesatellite.com. For a description of Aprize satellite, visit http://www.aprizesat.com.

28. For a description of FASAT, visit http://www.fasat.cl.

29. Brig Gen Simon "Pete" Worden, SMC/TR, Los Angeles, Calif., to author, E-mail, subject: Latin American Space Programs, 30 April 2003.

30. Lt Col Juan Berrios, US Embassy DATT staff, Santiago, Chile, to author, E-mail, subject: Latin American Space Programs, 19 March 2003; and Maj Jim Szczur, US Strategic Command, Colorado Springs, Colo., to author, E-mail, subject: Latin American Space Programs, 23 April 2003.

31. Taverna, 126.